SECTION 10

Rear Axle

INDEX

10 A REAR AXLE DIRECT DRIVE

10A.1 CROWN WHEEL PINION

PART A

Rear Axle-Direct Drive
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10A.1 SPECIFICATION

Rear Axle and Final Drive

Type	:	Direct Drive with 6X37 Crown Wheel pinion.
Track Width	:	52 to 72 inch (1320 to 1828 mm) (Adjustable in steps of 4 inch (102 mm))
Brakes Type	:	Dry Type Mechanical, Drum Brakes .Cam Operated 14X2 inch (355.6 X 50.8 mm) Size 2 Nos on LH and RH Sides with non Asbestos Liner
Location	:	Wheel end mounted
Method of operation	:	Manual, Individual LH/RH or combined pendant type Pedals

Parking Brakes

Type and Location	:	Service Brakes acts as Parking Brake Mounted on left hand side of the fender
Method of Operation	:	By hand lever through brake cables

Special Tools

Dial Test Indicator Gauge

SER / 019	:	Rear Axle shaft bearing remover
SER / 022	:	Rear Axle shaft bearing replacer
SER / 093	:	Axle shaft collar remover
SER / 028 / 20	:	Differential bearing puller
SER / 059 / 056	:	Pinion crown wheel bearing pusher

Bolt Torques

Rear Wheel Nuts	:	200 lbf ft. (271 Nm).
Axle Housing to Centre Housing	:	80 - 90 lbf ft. (108 - 122 Nm)
Axle Housing to Axle Retainer Hub	:	45 - 50 lbf ft. (61 - 68 Nm)
Lower Link Shaft	:	50 – 55 lbf ft. (68 - 75 Nm)
Axle shaft End Float	:	0.002 to 0.008 inch (0.05 to 0.2 mm).
Stabillzer bracket fender bolts	:	55 - 75 lbf.ft.(75 - 102 Nm)
Lower link pin nut	:	120 lbf.ft. (163 Nm)

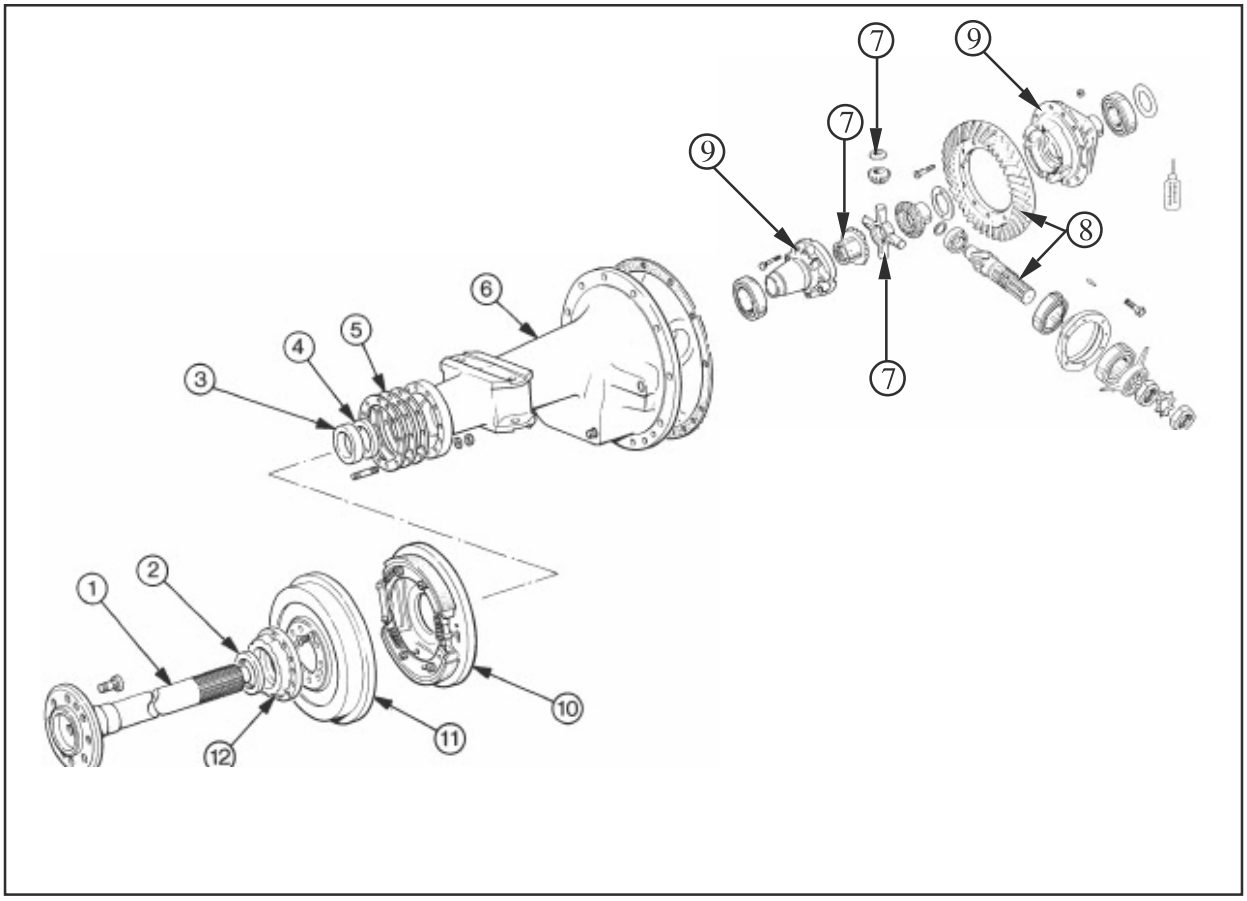

Fig. 1

1. Axle shaft
2. Oil Seal
3. Retainer
4. Oil Seal
5. Axle Shims
6. Axle Housing
7. Differential Gears and Pinions
8. Crown wheel and Pinion
9. Diff case LH and RH
10. Brake assembly
11. Brake drum
12. Retainer housing

10A. 2 GENERAL DESCRIPTION

The direct drive rear axle construction is shown in Fig.1. The axle shafts are splined directly into the differential gears and fitted with drum type brakes.

10A.3 AXLE SHAFT - DRUM BRAKE

Removal and Refitment

Special tools / Gauge

Dial Indicator gauge

Removal

1. Jack up the tractor under the axle housing to be serviced
2. Drain the transmission oil from centre housing and transmission case
3. Remove the rear wheel.
4. Slacken the brake adjuster. (Item 4 in Fig 2).
5. Remove the brake drum. (Item 1 in Fig 2).
6. Release the brake rods from the Cam shaft
7. Remove 12 bolts securing the retainer hub to Axle Housing. (Item 6 in Fig 2).
8. Withdraw the axle shaft complete with shims hub and bearing assembly and brake assembly. (Item 2 in Fig 2).
9. Remove the brake assembly and shims from the shaft. (Item 3 in Fig 2).

Refitment:

For refitment follow the reverse procedure of removal and ensure

1. Smear the inside of the brake camshaft bush in the axle housing with recommended grease.
2. Check the bearing cavity is full of recommended grease
3. Place the brake assembly and more shims than will be necessary on the axle shaft.
4. Taking care not to damage the oil seal on small end of axle housing. Place the axle shaft into the axle housing, simultaneously locating the brake camshaft.
5. Secure the hub with three of the bolts and spring washers, equally spaced and tighten to a torque of 45 - 50 lbs ft. (61 – 68 Nm).
6. Check the axle shaft end float on the left hand axle housing, using a dial test indicator gauge. (Item 1 in Fig 3). Remove shims as necessary to give an end float of 0.002 to 0.008 inch (0.050 - 0.2 mm) between the Axle ends.
7. Refit the remaining bolts and spring washers and tighten to torque of 45 - 50 lbf ft. (61 – 68 Nm).
8. Adjust the brakes

NOTE: *The right-hand axle shaft must be in place to enable this setting to be accomplished. If both shafts have been removed assemble the right-hand shaft with two shims to the value of 0.020 inch (0.51 mm), then make your adjustments on the other side. Start with one 0.015 inch (0.38 mm), two 0.020 inch (0.51 mm) and two 0.005 inch (0.13) mm shims.*

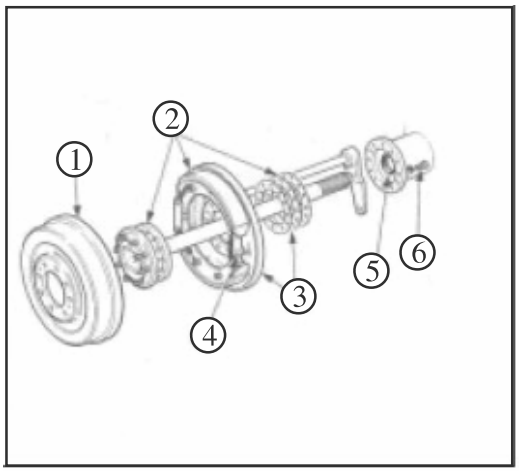

Fig. 2

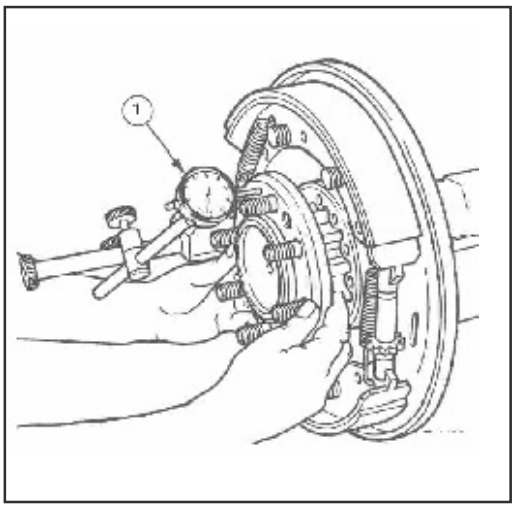

Fig. 3

S.NO	Shim thickness		Part number
	mm	inch	
1	0.0762 - 0.127	0.003 – 0.005	0183 259 M01
2	0.381 - 0.4318	0.015 – 0.017	0183 260 M01
3	0.508 - 0.5588	0.020 – 0.022	0183 261 M01

10A.4 AXLE SHAFT-DIRECT DRIVE-DRUM BRAKE

Over haul.

Disassembly

1. Remove the Axle shaft

WARNING: You are advised to wear eye protection during Procedure 2.

2. Drill the side of the bearing retaining collar using SER/093, then using a cold chisel, fracture the collar. (Item 1 in Fig 4).

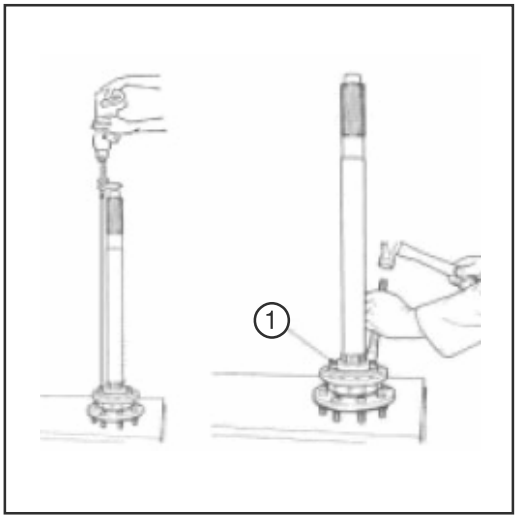

Fig. 4

3. With a hydraulic press, press the seal and bearing assembly . (Item 1 in Fig 5) off the shaft. Only remove the bearing cup if necessary.

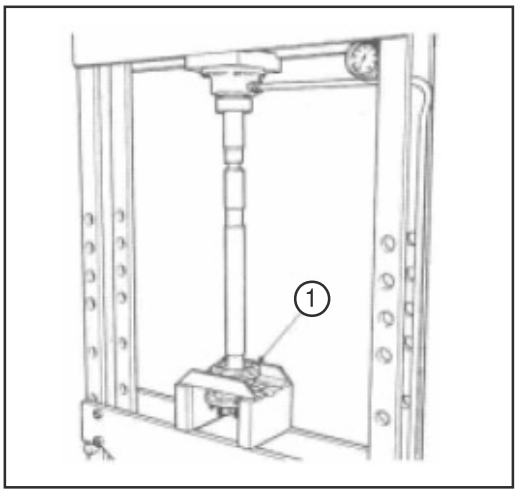

Fig. 5

4. Remove and discard the hub oil seal. (Item 1 in Fig 6).

5. Remove and discard the oil seal in the axle housing.

Re-assembly.

6. Coat the oil seal with loctite and press into the retainer hub up to the shoulder oil seal lip should face bearing. Fit a new cup if necessary (Item 2 in Fig 6).

7. Place the small quantity of high temperature grease between the oil seal and bearing. Position the bearing assembly, seal with retainer Hub and Axle shaft under a hydraulic press. Press the taper roller bearing cone in to position. (Item 1 in Fig 7).

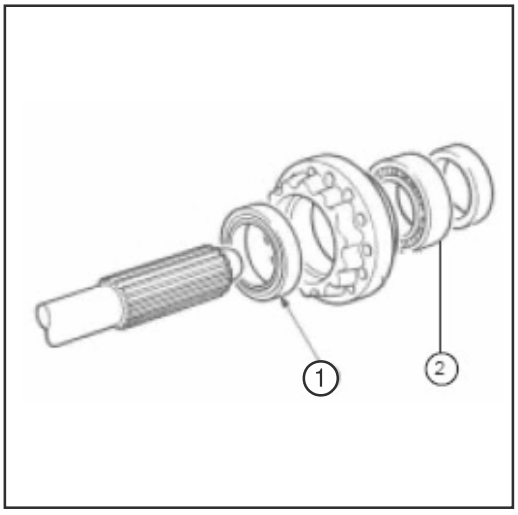

Fig. 6

8. Heat a new bearing retaining collar, until dull red and place it in position on the axle shaft.

9. Quickly drive the bearing retaining collar into position with a steel tube so that the hub and bearing assembly is held tightly in position. Ensure there is no gap between the collar and bearing cone (Item 1 in Fig 8) check with feeler gauge.

10. When cool, fill the bearing cavity with approximately 85 gm (0.187 lb) of high temperature bearing grease.

11. Replace the oil seal in the axle housing coating it first with loctite, the lip of the seal faces towards the crown wheel side.

12. Refit the axle shaft assembly.

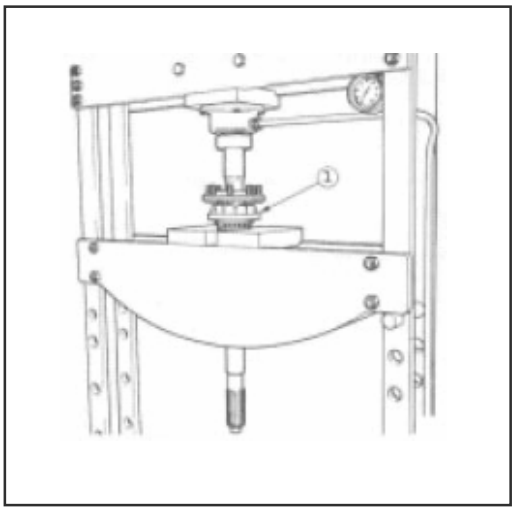

Fig. 7

10A. 5 AXLE HOUSING ASSEMBLY.

Removal and Refitment

1. Drain the transmission oil from transmission case and Centre Housing.

2. Remove the nuts and washers securing the Lower link to the axle housing.

3. Jack up the tractor under the axle housing being serviced. (Item 1 in Fig. 9).

4. Remove the rear wheel.

5. Support the tractor on a suitable stand or splitting trolley under the centre housing.

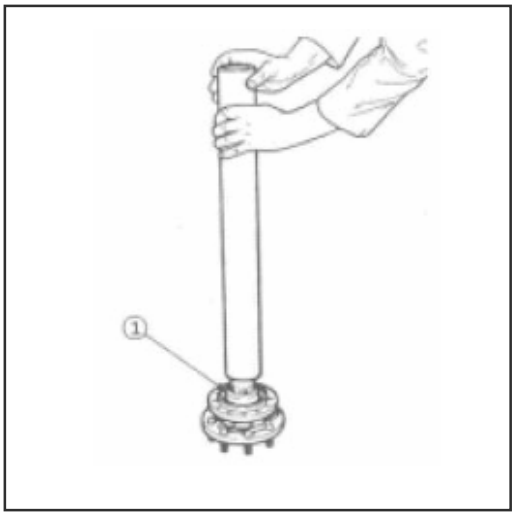

Fig. 8

6. Release the brake rods from the brake cam shafts.
7. Release the check chain at the check chain anchor bracket.
8. Remove the two nuts securing the stabiliser bracket to the axle housing.
9. Remove the stabiliser bracket.
10. Release the lift rod at the lift arm knuckle. (Item 2 in Fig. 9).
11. Remove the lower link assembly complete. (Item 3 in Fig. 9).
12. Disconnect the fender harness
13. Remove bolts from the fender. (Item 4 in Fig. 9).
14. Remove the fender Assembly.

WARNING: The axle housing is heavy and awkward to handle. Take care when removing and refitting.

15. Place a trolley jack under the centre of the axle housing being serviced, just supporting the housing.
16. Remove all nuts and bolts securing the axle housing to the centre housing. (Item 1 in Fig. 10).
17. Lower the axle housing slightly on the trolley jack.
18. Withdraw the axle housing assembly supported on the trolley jack.

CAUTION: When removing the left hand axle housing, the differential will need support to prevent it from falling out.

19. Remove the gasket from the centre housing and discard. (Item 2 in Fig.10).
20. Remove the thrust block from the left hand housing, if necessary. (Item 1 in Fig.11).
21. Remove the oil seal. (Item 3 in Fig. 10).

Refitment:

1. Replace the oil seal in the axle housing coating the outer diameter of oil seal with loctite. The lip of the seal should face towards crown wheel side.
2. If the shaft lower link has been removed from the axle housing, when refitting tighten the nut to a torque of (50 – 55 lbf ft.) 68 – 75 Nm. (Item 4 in Fig. 10).

For refitment follow the reverse procedure of removal and ensure

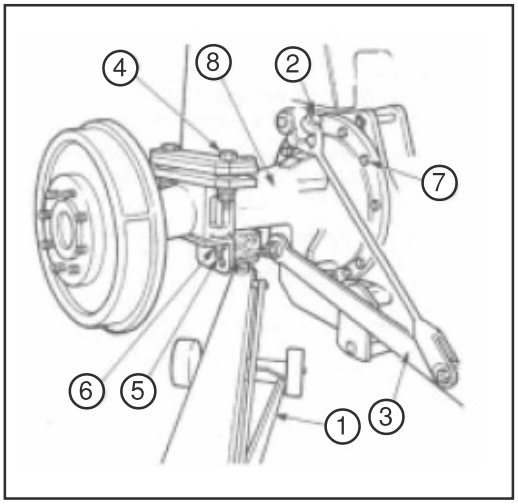

Fig. 9

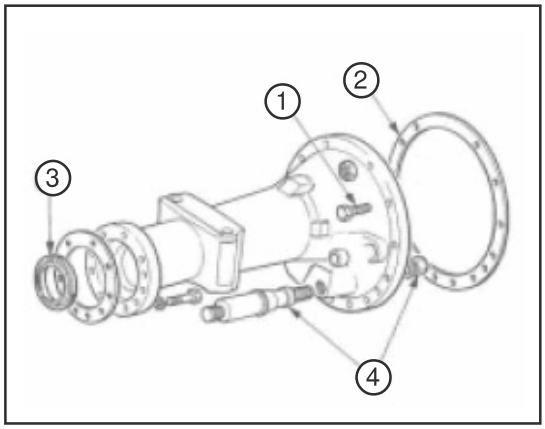

Fig. 10

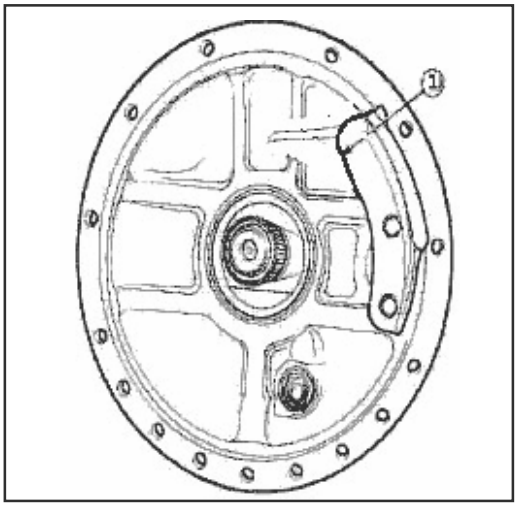

Fig. 11

(a) Fit a new gasket to the centre housing using petroleum jelly.

(b) When refitting the axle housing, take care to align the axle shaft splines in the differential unit and the studs through their holes in the axle housing.

(c) Tighten the axle housing nuts and bolts to a torque of 80 - 90 lbf ft. (102 – 122 Nm)

(d) Apply a few drop of loctite then fit and tighten the stabiliser bracket/fender bolts to a torque of 55 - 75 lbf ft. (75 – 102 Nm)

(e) Tighten the wheel nuts progressively and evenly to a torque of 200 lbf. ft. (271 Nm)

(f) Refill the transmission to the correct level with an approved oil.

10A. 6 LOWER LINK PIN - DRUM BRAKES

Removal and Refitment

Removal

Drain the transmission Oil.

1. Remove the axle housing.
2. Remove the nut and washer (Item 2 in Fig.12).
3. Remove the pin. (Item 1 in Fig. 12).

Refitment

1. Place a new pin in the axle housing if necessary.
2. Refit the washer and nut. (Item 2 in Fig.12).
3. Tighten the nut to a torque of 120 lbf. ft. (163 Nm).
4. Refit the axle housing.
5. Complete the rest of the assembly.
6. Fill up transmission oil to level mark.
7. Test for balanced brakes.

WARNING : The Axle housing is heavy and awkward to handle. Take care when both removing and refitting it.

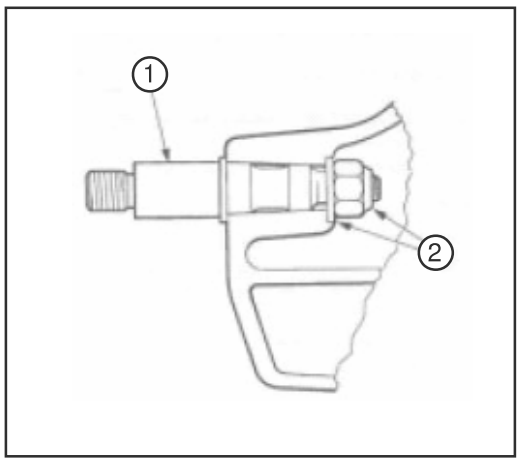

Fig. 12

PART B

Crown Wheel Pinion

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10A.1. 5	Differential Pre-load Check	10A -18

10A.1.1 SPECIFICATION

Type	:	Direct Drive with 6X37 Crown Wheel pinion
Crown wheel pinion ratio	:	6.1667:1

Special Tools

SER / 112	:	Differential Bearing pre load gauge (used in conjunction with SER / 060 and SER / 064)
SER / 018	:	Bench plate
SER / 017	:	Differential case holder adaptor (to be used with SER/018)
SER / 038	:	Hand press
SER / 059	:	differential case bearing removing adaptor used in conjunction with hand press SER / 038
SER / 020	:	Adaptor
SER / 025	:	Differential bearing cup replacer
SER / 030	:	Differential bearing cup remover
SER / 031	:	Adaptor (to be used with SER / 030)
SER / 060	:	Pinion lock nut “C” spanner
SER / 064	:	Perload checking gauge aid.
T 4062 A	:	Pre load weight

Bolt Torques

Differential case Bolts	:	76 – 85 lbf.ft. (108 Nm)
Crown Wheel Bolts	:	118 lbf.ft. (160 Nm)
Axle Housing Bolts	:	85 – 89 lbf.ft. (115 - 120 Nm)
Pinion Housing to Centre Housing Bolts	:	75 – 80 lbf.ft. (102 - 108 Nm)
Shaft Lower Link.	:	50 – 55 lbf.ft. (68 - 75 Nm)
Pinion Bearing pre load	:	18 – 22 lbf.inch. (2 - 2.5 Nm)

10A.1.2 GENERAL DESCRIPTION

The drive from the transmission main shaft is transmitted through the rear drive shaft and shear coupler / tube to a spiral bevel gear pinion driving the crown wheel and then through the axle shafts.

The driving pinion is supported in the centre housing by a straight roller pilot bearing and a pre loaded housing assembly carrying two tapered roller bearings.

The crown wheel is rivetted / bolted to the split differential case which is supported on each side by tapered roller bearings. The differential unit consists of two differential gears and four pinions.

The differential gears engages with axle shaft spline. The differential pinions run on differential cross and the thrust is taken by thrust washers behind the pinions and gears.

The pinion pre-load is set by tightening a nut behind the two taper roller bearings. The differential bearing pre-load is set with the aid of a special tool and variable thickness bearing shim which are fitted behind the bearing cup of the right hand axle housing.

10A.1. 3 DIFFERENTIAL UNIT

Overhaul :

Special Tools :

SER / 017 : Differential case holder adaptor (to be used with MF 10).

SER / 018 : Bench plate

SER/112 : Bearing pre-load gauge

SER / 020 : Adjustable puller main tool

Dis-assembly

WARNING : The axle housing and differential unit are heavy and awkward to handle. Take care when removing and refitting them.

1. Remove the left-hand axle housing.
2. Maneuver the differential assembly out of the centre housing.
3. Place the differential on a stand or in a vice (SER / 017 / 018). (Fig. 1)
4. Using puller SER / 020 / 028 remove the bearing right hand cone. (Fig. 2)
5. Remove the eight bolts. (Item 4 in Fig. 3)
6. Remove the differential case right-hand (Item 2 in Fig. 3)
7. Remove the 4 pinions and gears from differential cross complete with the thrust washers. (Item 3 in Fig. 3)
9. Remove the differential gears and their thrust washers. (Item 1 in Fig. 3)

Examination :

Examine all of the differential components and replace any that are worn out or damaged.

***NOTE** : If any of the differential gears or pinions are worn, a full set of four new differential gears and pinions must be fitted.*

Fig. 1

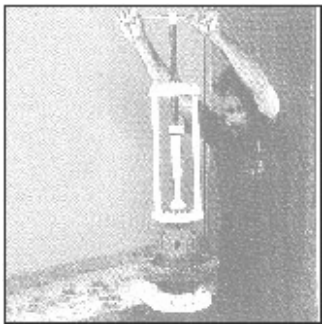

Fig. 2

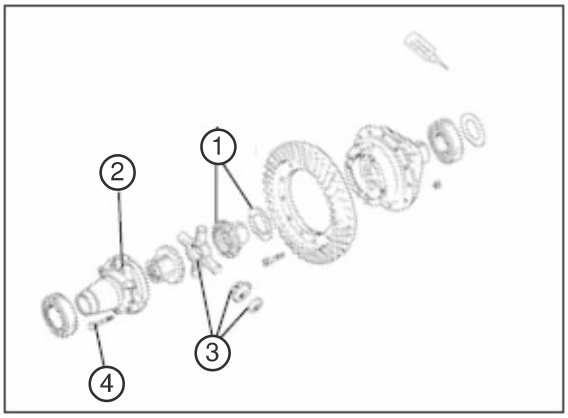

Fig. 3

Fig. 4

Reassembly

1. For reassembly follow the reverse procedures of the disassembly and ensure
   (a) Refit the right hand differential case with left-hand aligning the number punches on left-hand and right-hand.
   (b) Tighten the eight bolts to a torque of 76-85 lbf. ft. (108 Nm)
   (c) Refit the bearing cone using (SER / 025)
   (d) Refit the differential unit with care. It must engage with the splines on the right side axle shaft.

   ***NOTE** : If the differential bearings or case have been replaced, the pre-load must be checked. (Ref. Operation No. 10A.1.5)*
2. Refit the left hand axle housing,

10A.1. 4 CROWN WHEEL & PINION

Overhaul

Special Tools :

SER/112 : Bearing pre-load gauge

Disassembly

Crown Wheel

***NOTE** : The replacement crown wheel and pinion kit comprises of one pinion, one crown wheel, 12 nuts and bolts and one epoxy resin kit.*

1. Split the tractor between the centre housing and the gear box
2. Remove the Hyd. lift cover
3. Remove the axle Housing left-hand
4. Remove the differential unit
5. Place the differential unit on a bench.
6. Centre punch each of the rivets centrally.
7. Using a 13 -14 mm drill, drill out each of the rivet heads until they become detached from their shanks. (Item 1 in Fig. 5). (Ensure that the holes in diff. case left-hand are not getting elongated during the process of drilling out the rivets).
8. Drive out the rivets.
9. Separate the crown wheel from diff. case left-hand.

   ***NOTE** : crown wheels and pinions are supplied as matched sets, therefore when fitting a new crown wheel, the pinion must also be replaced.*

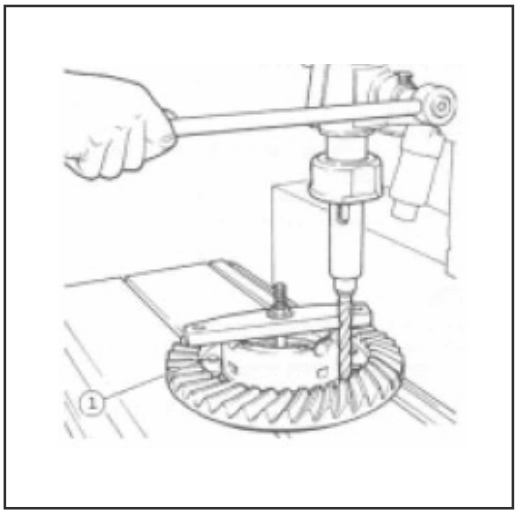

Fig. 5

Pinion:

1. Remove the six mounting bolts. (Item 1 in Fig. 6).
2. Screw one of the bolts into each of the two tapped holes. (Item 2 in Fig. 6).
3. Tighten the bolts as shown using a ring spanner thus withdrawing the pinion assembly.
4. Remove the locking nut as follows.

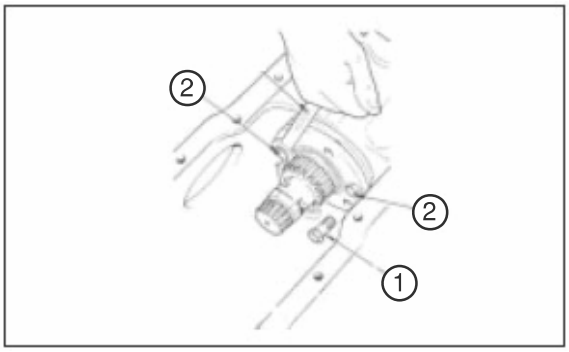

Fig.6

WARNING : Eye protection goggle must be worn during the following operations

NOTE : *Great care should be taken to avoid damaging the threads of the pinion if it is to be reused.*

(a) Place the pinion in a vice with soft jaws, holding the flats, adjacent to the collar locking rollers.

(b) Using a cold chisel, cut one half to two thirds into the locking collar at points "B" and "C". (as shown in Fig.7).

(c) Reposition the pinion in the vice and chisel down the splines into the cuts made at points 'B' and "C". A few hefty blows will fracture the locking collar enabling it to be removed.

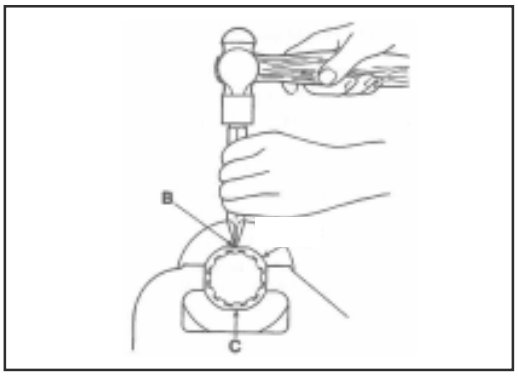

Fig. 7

5. Remove the oil slinger. (Item 2 in Fig.8).
6. Remove the sleeve pinion assembly, pinion and the bearing cone. (Item1 in Fig. 8).

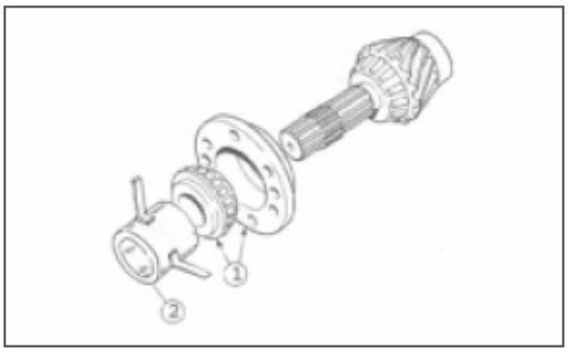

Fig. 8

7. Use a hand or hydraulic press and remove the front taper roller bearings. (Fig. 9).

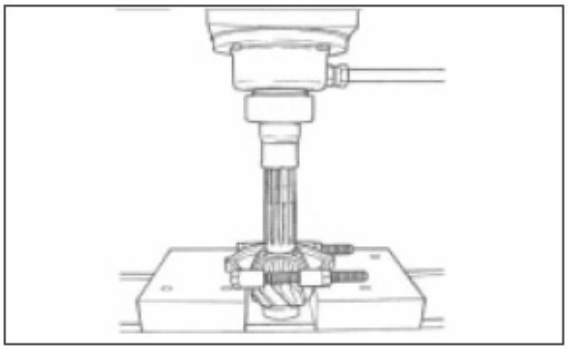

Fig. 9

8. Remove the snap ring securing the pilot bearing to the pinion using a circlip plier.
9. Remove the pilot bearing in a press (Fig.10).

Examination :

Examine all components for signs of wear, scoring or pitting. Any faulty or worn parts must be replaced.,

NOTE :

(a) If the pinion is damaged the crown wheel must also be replaced as these are only supplied in matched sets.

(b) If the taper roller bearing needs replacement it should be replaced as a set (i.e. cup and cone).

(c) New snap rings should always be fitted.

Reassembly

Pinion

1. Press the pilot bearing on to the pinion (Fig.11).
2. Secure the pilot bearing with a new snap ring.
3. Press the taper roller bearing on to the pinion (SER / 059 / 056). (Fig. 12).
4. Locate the pinion in its housing and fit the front bearing cone.
5. Refit the oil slinger in position. Fit a new locking ring and hand tighten.
6. Hold the housing in a soft faced vice.
7. Fit the preload gauge, SER / 064 to the pinion and tighten the locking ring to give a preload reading of 2 - 2.5 Nm (18 -22 lbf inch). (Fig.13).

   Set the weight on gauge T 4062 A so that when the preload is correct the arm will just fall under its own weight with a light touch of the finger.

8 Remove the gauge, tap the pinion firmly to centralise the bearings, then recheck the preload.

9. Secure the locking ring by driving a locking roller down either side of one of the pinion splines. (Item 1 in Fig.14).

   NOTE : *The locking rollers must be driven flush, with the collar.*

   Before re fitment, the pinion assembly should be freely lubricated with clean transmission oil.

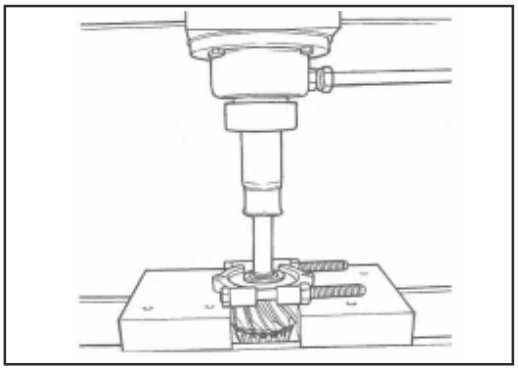

Fig.10

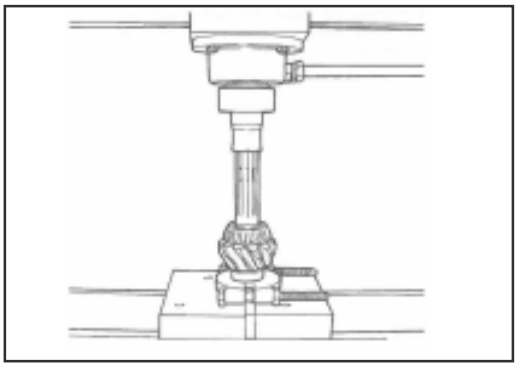

Fig. 11

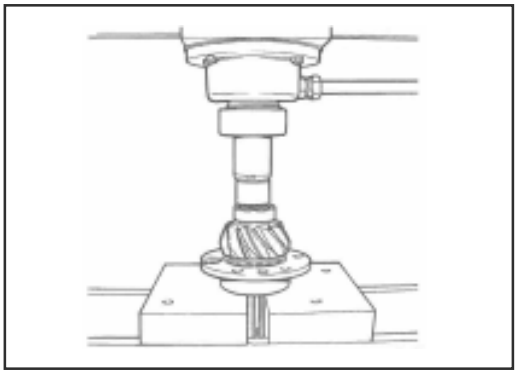

Fig. 12

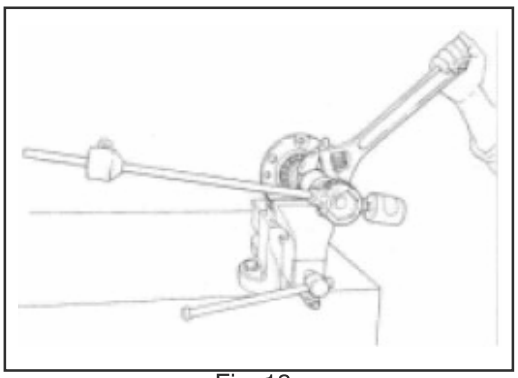

Fig. 13

(a) Ensure that the dowel pin in the sleeve Pinion is aligned with the hole in the centre housing before driving the sleeve into place.

(b) Tighten the six bolts to a toque of 102–108 Nm (75 - 80 lbf.ft).

Pinion Preloading (With Double Lock Nuts)

1. Using the lock nut "C" spanner (SER 060) and preload checking gauge (T 4062 - A) aid tighten the pinion lock nut till it reaches the face of the bearing (Fig. 14A).

   NOTE : *Few drop of oil to be applied on the sleeve bearing before tightening.*

2. Fix the pinion pre-load gauge to the pinion and position the weight at the 18 inch scale position. Tap the scale. The tool should come down. If not adjust the lock nut tightening accordingly. The tool should come down only when it is tapped and not on its own (Fig. 14B).

3. Position the weight at the 22 inch (558.8 mm) scale position and tap the scale. The moment the scale is tapped the tool should come down smoothly without any interruption. If not, adjust the locknut accordingly using "C" spanner and pre-load checking gauge.

4. Insert tab washer, assemble the second lock nut and tighten to 2 - 2.5 Nm (18 to 22 lbf inch). Recheck the pre-load and then bend the tab washer in the slot given on both lock nuts.

   Note : *1. Repeat the procedure 2 to 3 times and on occasion drive the pinion with the dead-blow hammer to ensure the pinion freely rotates.*

   2. Tap the scale by using finger only.

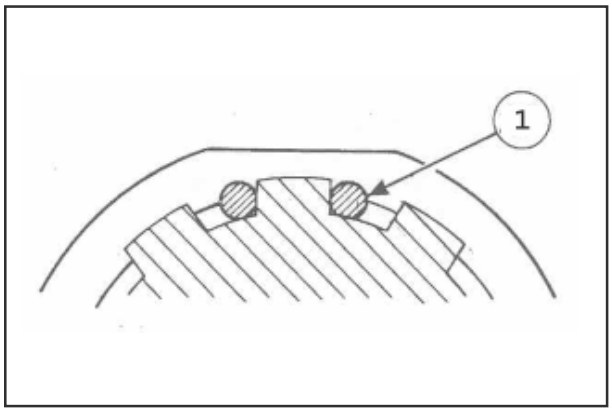

Fig. 14

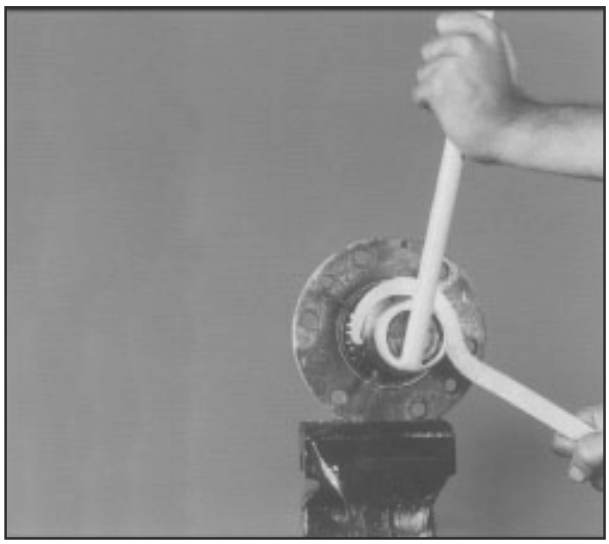

Fig. 14 A

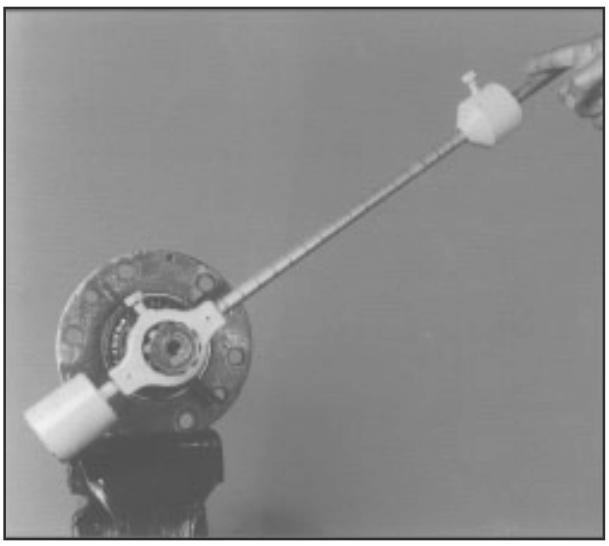

Fig. 14 B

Crown Wheel :

1. Ensure that the mating faces of the differential case and the new crown wheel are perfectly flat. (Item 1 in Fig.15)
2. Fit the left hand differential case, with the mating face upwards in a bench plate (SER / 017 / 018) (Item 2 in Fig.15)
3. Decrease the crown wheel, left hand differential case, differential bolts and nuts.
4. Collect together all items necessary for speedy assembly.
5. Open epoxy resin kit, its contents are one jar containing 10 ml. of resin. This jar is also used as a mixing vessel). One jar containing 5 ml. of hardener .One glass stirring rod one brush.

   WARNING : Avoid excessive or repeated skin contact. Observe the directions on the container.

   NOTE : *Operations 6 -12 that follow, must be completed within 30 minutes of mixing the resin and hardener.*
6. Pour the hardener into the resin jar and mix thoroughly using the glass rod. .
7. Apply an even coating of adhesive to both Item 1 not shown for crown wheel bottom mating surfaces. (Item 1 in Fig.16).
8. Press the differential case on to the crown wheel.

   NOTE : *These two components are an interference fit and must, therefore, have their bolt holes aligned accurately before being fitted together.*
9. Fit the twelve bolts (Item 2 in Fig.16) with their heads nearest the crown wheel teeth.
10. Apply two drops of Stud lock (Loctite 270) to the first thread of each bolt.

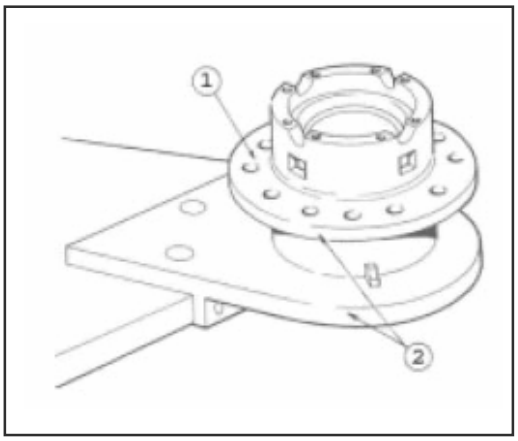

Fig. 15

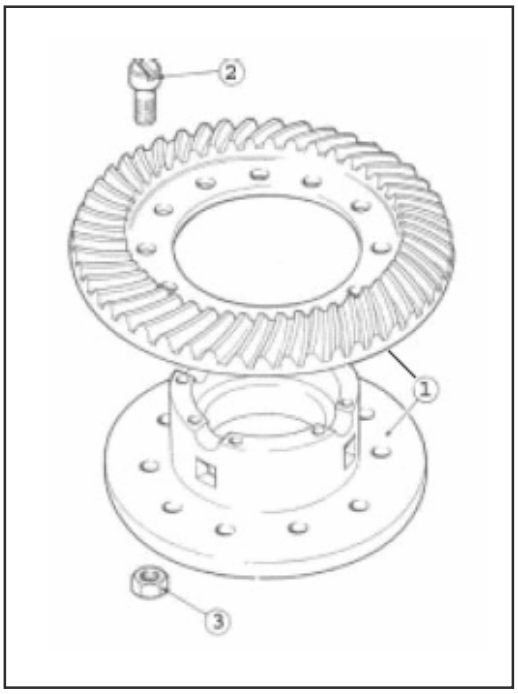

Fig.16

11. Fit the nuts and tighten them progressively and evenly to a torque of 160 Nm.(118 lbf.ft.) (Item 3 in Fig.16).
12. Refit the differential components.
13. Cure the resin bonding by subjecting the differential assembly to uniform heating as follows.

    120°C (248°F) for a minimum of 1 hour

    or 40° C (104°F) for a minimum of 12 hours.

    or 30° C (86°F) for a minimum of 16 hours.

    or 20°C (60°F)for a minimum of 24 hours.
14. Press on the right hand differential bearing cone.
15. Press in the left hand differential bearing cone.
16. Refit the differential unit on to the centre Housing.
17. Refit the left hand Axle housing.
18. Set the differential bearing preload if differential. bearings / differential.case / crown wheel pinion is changed. (See Operation No.10A.1.5 below)
19. Refit the axle housing assembly, lift cover assembly on the centre housing and assemble the rest of the tractor. Adjust the brake.
20. Refill the transmission with oil.
21. Road test the tractor and inspect for oil leaks.

NOTE : *Since hydraulic lift cover has been removed and refitted it is necessary to recheck the hydraulic settings.*

10A.1. 5 DIFFERENTIAL PRE-LOAD

Check

Special Tools

Preload Gauge (SER/112) (Fig. 17).

Note : *This check must be carried out whenever the differential unit is disassembled, or if the bearings have been replaced.*

Procedure

1. All preload check are made on the right hand side.
2. Assemble the left side axle housing assembly.
3. Do not fit the bearing cup to the right hand axle housing.
4. Centrally position the centraliser along with bearing cup over the differential case right-hand taper roller bearing. (Fig.18)

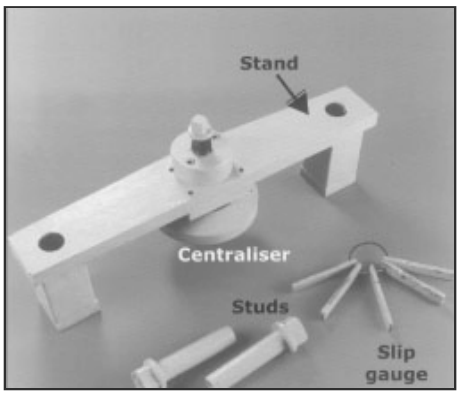

Fig. 17

Fig. 18

5. Fix the tool stand to centre housing using 2 studs (Fig.18) and tighten the centre nut to a torque of 25 Nm (18 lbf.ft.).

   Ensure the tool seating area on the center housing is clean and without axle housing gasket.

6. Measure the gap between the tool stand and tool Centraliser using Slip Gauge. The gap measured by slip gauge determines the shim thickness. (Fig. 19).

   Note :

   (a) Ensure proper seating of tool stand on the Centre Housing.

   (b) Do not overtighten the centre nut of the tool.

   (c) Slip gauge should enter freely in the gap. Note the slip gauge number and select the shim from the table corresponding slip gauge number.

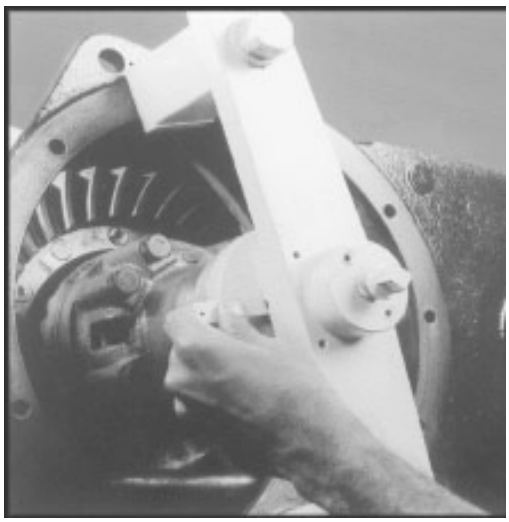

Fig. 19

Slip gauge No	Shim Thickness		Part number	Identification mark
	mm	inch		
A	1.24 - 1.30	0.048 - 0.051	715 631 M1	5 cuts
B	1.12 - 1.17	0.044 - 0.046	715 632 M1	4 cuts
C	0.99 - 1.04	0.038 - 0.040	715 633 M1	3 cuts
D	0.86 - 0.91	0.033 - 0.035	715 634 M1	2 cuts
E	0.74 - 0.79	0.029 - 0.031	715 640 M1	1 cuts
F	0.61 - 0.66	0.024 - 0.025	715 692 M1	No cut

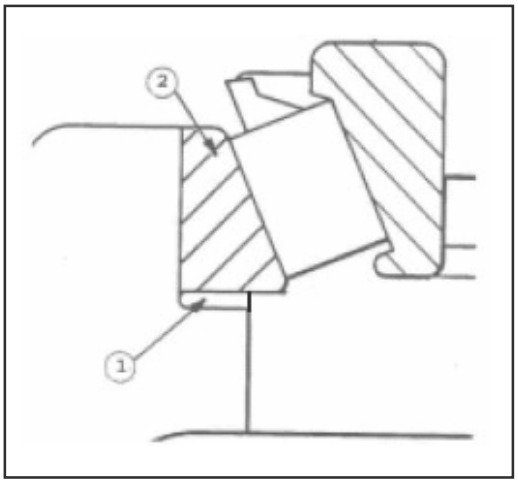

Fig. 20

7. After selecting the shim, remove the tool assembly from centre housing and the Cup Bearing. Fit the selected shim (Item1 in Fig. 20) behind the Cup Bearing (Item 2 in Fig. 20) on the Axle Housing right-hand in the usual manner.

8. Refit the bearing cup, ensuring that it is fully seated.

9. Refit the right- hand Axle housing.

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